DECLARATION UNDER 37 C.F.R. 1.132

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Ok Byoung KIM et al.

Application No. 10/687,993 Group Art Unit 2889

Confirmation No. 1374

Filed: October 20, 2003 Examiner: Karabi Guharay

For: DISPLAY DEVICE HAVING CRYSTAL GRAIN BOUNDARIES PROVIDING SUPERIOR DRIVING AND LUMINANCE CHARACTERISTICS

Declaration Under Rule 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, ok Byoung Kim have reviewed the above identified patent application, references, and arguments set forth in the Office Action and declare as follows:

1. I have received a degree in electronics from hongik univ and have 8 years of experience in the field of amoled and am aware of the state of the art from the time of 1997 and 1999

2. I have reviewed and understand the references, the claims, and the arguments in the Office Action;

3. I have found that Mitanaga et al. (U.S. Patent No. 5,923,997) does not teach primary and secondary crystal grain boundaries as recited in claims 1, 2, 4, 5, 7, 11-13 of the present application for the following reasons:

   a. Mitanaga discloses a metal induced lateral solidification (MILS) method which is different from the sequential lateral solidification (SLS) method used in the aspects of the present invention, and therefore the structures taught by Mitanaga have substantial differences from those recited in the claims; and

b. Mitanaga does not inherently result in the formation of primary crystal grain boundaries perpendicular to secondary crystal grain boundaries because of the use of a different method than that of the present application and recited in the claims.

4. I have found that Mitanaga et al. (U.S. Patent No. 5,923,997) and FIGS. 5B and 5C do not teach primary and secondary crystal grain boundaries formed perpendicular to each other for the following reasons:

a. While one type of grain boundary is illustrated in FIGS. 5B and 5C of Mitanaga, the grain boundary is in a different form and is perpendicular to the grain boundary;

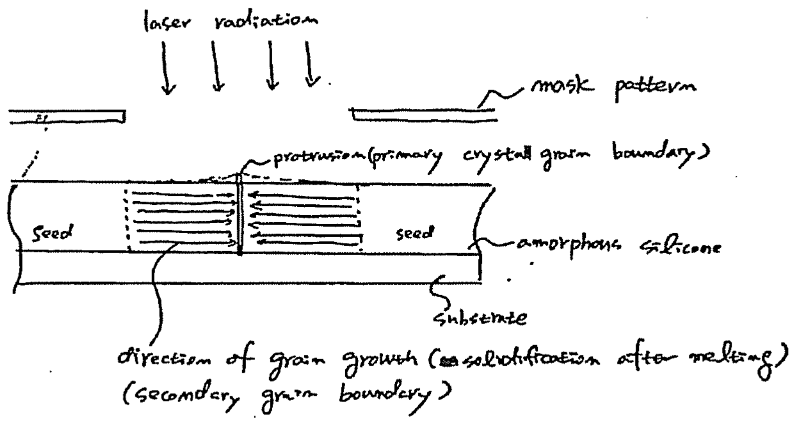
b. As illustrated in FIG. 1, noted below, in the SLS crystallization method, when a laser is used, so that amorphous silicon is molten and solidified to be crystallized, a mask pattern is used to irradiate a laser only onto a part of an amorphous silicon layer. As a result, the amorphous silicon layer in which a crystallization seed is not molten is formed. Therefore, when the silicon is solidified after it is molten, crystallization begins from the amorphous silicon, and thus begins in a direction parallel to the substrate;

c. As described above, as the crystallization proceeds, crystal growth is made in opposite directions, and thus a place where grains meet is formed. A grain boundary is formed at this place. Further, a protrusion is formed at this place, and another grain boundary is formed at this place in the SLS crystallization method (ELA crystallization as well as SLS);

d. In particular, in the SLS crystallization method, only a part of the silicon is molten using the mask pattern, and thus grain boundaries are inevitably formed perpendicular to a crystal growth direction. These grain boundaries are defined as "primary grain boundaries";

e. Further, during the crystal growth, grains are grown in a crystal growth direction, and the neighboring grains meet each other, so that grain boundaries are formed parallel to the crystal growth direction. The grain boundaries are parallel to the crystal growth direction, but they are inevitably perpendicular to the above-mentioned "primary grain boundaries;"

FIG. 1



f. However, the MILC crystallization method of Mitanaga exhibits a different mechanism. Such a mechanism is disclosed in column 2, line 39 - column 3, line 18 of Mitanaga;

g. That is, as illustrated in the following FIG. 2, in the general MILC (including MIC) crystallization method, the crystallization is made using a metal catalyst for inducing crystallization (in general, Ni is used) as a crystallization seed;

h. As disclosed in column 2, lines 57 to 64 of Mitanaga, the reference discloses that "it was considered that the temperature of crystallization can be lowered by more positively introducing the crystalline nucleus, and for the purpose of confirming the effect, a bit of other metals was formed on the substrate, and a thin film of the amorphous silicon was then formed thereon." Accordingly, the metal catalyst for inducing crystallization, i.e. the crystallization seed (crystallization nucleus), is formed at an interface between the substrate and the amorphous silicon. Afterwards, when annealing is performed after the seed is formed, grains are grown from the seed. Due to the crystal growth, grain boundaries are finally formed at the places where the grains meet each other;

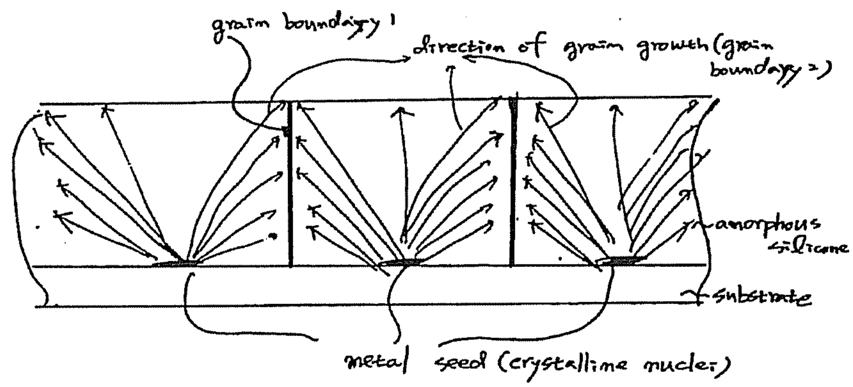
i. Accordingly, the grain boundary 216 illustrated in FIGS. 5B and 5C of Mitanaga corresponds to a grain boundary 1 illustrated in FIG. 2;

j. Moreover, in the MILC (MIC) method taught by Mitanaga, and as shown below, the grains are grown and finally have a columnar shape;

k. Therefore, in Mitanaga, two grain boundaries inevitably perpendicular to each other are not formed. As illustrated, in the following FIG. 2, a grain boundary 2 is formed between the neighboring grains. However, the grain boundary 2 is parallel to a crystal growth direction, but is not perpendicular to the grain boundary 1;

l. The MILC (MIC) crystallization method is a solid-phase crystallization method, and amorphous silicon is not molten during crystallization. As such, the finally formed grain boundary 1 illustrated in FIG. 2 does not protrude; and

FIG. 2



m. Therefore, the SLS crystallization method of the aspects of the present invention is completely different from the MILC (MIC) crystallization method of Mitanaga in terms of crystallization mechanism and the structure formed, and thus the position and size of finally obtained grain boundaries are different in both inventions. Therefore, Applicants respectfully assert that Mitanaga fails to teach or suggest the novel features recited in independent claim 1.

The Declarant further states that the above statements were made with the knowledge that willful false statements and the like are punishable by fine and/or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statement may jeopardize the validity of this application or any patent resulting therefrom.

By: OK Byoung Kim Date 2009. 12. 1